CLAIMS

What is claimed is:

1. A packet processing system comprising:

first means for providing a plurality of quality of service indicators for a packet, each with an assigned priority; and

second means for utilizing a configurable priority resolution scheme to select one of the plurality of quality of service indicators for assigning to the packet.

2. The system of claim 1 wherein the first means maps one or more fields of the packet into a quality of service indicator for the packet and an associated priority.

3. The system of claim 1 wherein the first means conducts a search to obtain a quality of service indicator for the packet and an associated priority.

4. A packet classification system comprising:

a slicer for slicing some or all of a packet into portions and providing the portions in parallel over a first data path having a first width to a classification engine;

the packet classification engine configured to classify the packet responsive to the packet portions received over the first data path and provide data representative of the packet classification; and

an associator for associating the data representative of the packet classification with some or all of the packet, and providing the associated packet packet over a second data path having a second width less than the first width.

5. The system of claim 4 wherein the slicer comprises a plurality of memories configured to store some or all of the packet, and provide the portions thereof in parallel over the first data path to the classification engine.

6. The system of claim 5 wherein the plurality of memories are configured to provide each of the bits of some or all of the packet in parallel over the first data path to the classification engine.

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7.   The system of claim 4 wherein the associator comprises a multiplexor configured to multiplex onto the second data path the data representative of the packet classification and some or all of the packet.

8.   A packet modification system comprising:

5   a buffer for providing some or all of a packet as packet portions and providing the portions in parallel over a first data path having a first width to a modification engine;

the modification engine configured to receive the packet portions over the first data path, and, responsive thereto, modify one or more of the packet portions; and

10   an assembler for assembling a packet from one or more modified and one or more unmodified packet portions, and providing the assembled packet over a second data path having a second width less than the first width.

9.   The system of claim 8 wherein the buffer comprises a plurality of memories configured to store a packet and provide portions thereof in parallel over

15   the first data path to the modification engine.

10.   A packet classification system comprising:

control logic for maintaining first and second stacks, the first stack for identifying those packets which are awaiting classification by the packet classification system, and the second stack for identifying those packets which are undergoing

20   classification by the classification system,

wherein the control logic is configured to place an identifier of a packet on the first stack upon or after receipt of the packet by the packet classification system, pop the identifier off the first stack and place it on the second stack upon or after initiation of classification processing of the packet by the packet classification system, and pop

25   the identifier off the second stack upon or after completion of classification processing of the packet by the packet classification system,

and the packet classification system is prevented from outputting a packet while an identifier of the same is placed on either the first or second stacks, and is free to output the packet upon or after the identifier of the packet has been popped off the

30   second stack.

11. The system of claim 10 wherein the control logic is a state machine.

12. A packet statistics maintaining system comprising:

control logic for allocating a packet size determiner to a packet from a pool of packet size determiners, the packet size determiner configured to determine the size of the packet, and the control logic configured to return the packet size determiner to the pool upon or after the same has determined the size of the packet;

a memory for maintaining packet statistics; and

a statistics updater for updating the packet statistics responsive to the determined size of the packet.

13. The system of claim 12 wherein the control logic is a state machine.

14. The system of claim 12 wherein the packet size determiner is a counter configured to count the size of the packet.

15. The system of claim 12 wherein the statistics updater includes a queue for queuing statistics update requests issued by the control logic.

16. The system of claim 12 wherein the memory is configured to maintain packet statistics indicating the cumulative size of packets which have met specified processing conditions or hits, and the statistics updater, upon or after a packet size determiner has determined the size of a packet, is configured to increment a cumulative size statistic for a particular processing condition or hit by the determined size of the packet if the packet satisfies that particular processing condition or hit.

17. A packet classification system comprising:

a buffer for buffering a packet upon or after ingress thereof by the system;

a classification engine for classifying the packet and providing data representative of the packet classification; and

an associator for associating the data representative of the packet classification with some or all of the packet as directly retrieved from the buffer to form an associated packet on an egress data path of the system.

18. The system of claim 17 wherein the associator comprises a multiplexor configured to multiplex the data representative of the packet classification and some or all of the packet as directly retrieved from the buffer onto the egress data path.

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19.   A packet modification system comprising:

a buffer for buffering the packet upon or after ingress thereof by the system;

a modification engine for modifying one or more portions of the packet; and

an assembler for assembling one or more modified portions of the packet with

5   one or more unmodified portions of the packet as retrieved directly from the buffer to

form an assembled packet on an egress path of the system.

20.   The system of claim 19 wherein the modification engine is configured

to provide a list indicating which portions of the assembled packet are to comprise

modified portions of an ingress packet, and which portions are to comprise

10   unmodified portions of the ingress packet, and the assembler is configured to

assemble the assembled packet responsive to the list.

21.   A method of assigning a quality of service indicator to a packet

comprising:

providing a plurality of quality of service indicators for a packet, each with an

15   assigned priority; and

utilizing a configurable priority resolution scheme to select one of the plurality

of quality of service indicators for assigning to the packet.

22.   The method of claim 21 wherein the providing step comprises mapping

one or more fields of the packet into a quality of service indicator for the packet and

20   an associated priority.

23.   The method of claim 21 wherein the providing step comprises

performing a search to obtain a quality of service indicator for the packet and an

associated priority.

24.   A method of classifying a packet comprising:

25   slicing some or all of a packet into portions and providing the portions in

parallel over a first data path having a first width to a classification engine;

in the packet classification engine, classifying the packet responsive to the

packet portions received over the first data path and providing data representative of

the packet classification; and

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associating the data representative of the packet classification with the packet to form an associated packet, and providing the associated packet over a second data path having a second width less than the first width.

25. The method of claim 24 wherein the providing step comprises providing each of the bits of some or all of the packet in parallel over the first data path to the classification engine.

26. The method of claim 24 wherein the associating step comprises multiplexing the data representative of the packet classification and some or all of the packet onto the second data path.

27. A method of modifying a packet comprising:

slicing some or all of a packet into packet portions and providing the portions in parallel over a first data path having a first width to a modification engine;

in the modification engine, modifying one or more packet portions; and

assembling a packet from one or more modified and one or more unmodified packet portions, and providing the assembled packet over a second data path having a second width less than the first width.

28. A method of classifying a packet comprising:

placing an identifier of a packet on a first stack;

popping the identifier off the first stack and placing it on a second stack upon or after initiation of classification processing of the packet;

popping the identifier off the second stack upon or after completion of classification processing of the packet;

avoiding outputting the packet while an identifier of the same is placed on either the first or second stacks; and

outputting the packet upon or after the identifier of the packet has been popped off the second stack.

29. A method of maintaining packet statistics comprising:

allocating a packet size determiner to a packet from a pool of packet size determiners;

using the packet size determiner to determine the size of the packet;

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returning the packet size determiner to the pool upon or after the same has determined the size of the packet; and

updating one or more packet statistics responsive to the determined size of the packet.

30. The method of claim 29 wherein the packet size determiner is a counter which counts the size of the packet.

31. The method of claim 29 further comprising queuing one or more statistics update requests.

32. The method of claim 29 wherein the one or more packet statistics indicate the cumulative size of packets which have met specified processing conditions or hits, and the updating step comprises incrementing a cumulative size statistic for a particular processing condition or hit by the determined size of the packet if the packet meets that particular processing condition or hit.

33. A method of classifying a packet comprising:

buffering a packet in a buffer upon or after ingress thereof;

classifying the packet and providing data representative of the packet classification; and

associating the data representative of the packet classification with some or all of the packet as directly retrieved from the buffer to form a packet that is placed on an egress data path.

34. The method of claim 33 wherein the associating step comprises multiplexing the data representative of the packet classification onto a data path followed by some or all of the packet as directly retrieved from the buffer.

35. A method of modifying a packet comprising:

buffering the packet in a buffer upon ingress thereof;

modifying one or more portions of the packet; and

assembling the one or more modified portions of the packet with one or more unmodified portions of the packet as retrieved directly from the buffer to form an assembled packet that is placed on an egress data path.

36. The method of claim 35 further comprising providing a list indicating which portions of the assembled packet are to comprise modified portions of an ingress packet, and which portions are to comprise unmodified portions of the ingress packet, and the assembling step comprises assembling the assembled packet responsive to the list.

37. A system for preventing re-ordering of packets in a packet processing system comprising:

first logic for assigning a sequence number to a packet upon or after ingress thereof to the system;

second logic for processing the packet;

third logic for storing data representative of the packet in a buffer; and

fourth logic for checking the buffer for an entry matching an expected next sequence number, outputting the corresponding packet if a match is present, and deferring outputting a packet if a match is not present.

38. The system of claim 37 wherein the fourth logic is configured to maintain an expected next sequence number for each of a plurality of output channels, check the buffer for a match for each of the channels, and output the corresponding packet on a channel if a match for that channel is present, and defer outputting a packet on a channel if a match for that channel is not present.

39. A method of preventing re-ordering of packets in a packet processing system comprising:

assigning a sequence number to a packet upon or after ingress thereof to the system;

processing the packet;

storing data representative of the packet in a buffer; and

checking the buffer for an entry matching an expected next sequence number, outputting the corresponding packet if a match is present, and deferring outputting a packet if a match is not present.

40. The method of claim 39 wherein the checking step comprises maintaining an expected next sequence number for each of a plurality of output

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channels, checking the buffer for a match for each of the channels, outputting the corresponding packet on a channel if a match for that channel is present, and deferring outputting a packet on a channel if a match for that channel is not present.

41. A packet classification system comprising:

means for buffering the packet upon or after ingress thereof to the system;

means for slicing some or all of a packet into portions and providing the portions in parallel over a first data path having a first width to packet classification means, the packet classification means configured for classifying the packet responsive to the packet portions, and providing data representative of the packet classification;

means for associating the packet classification data with the packet as directly retrieved from the means for buffering to form an associated packet, and providing the same over a second data path having a second width less than the first width; and

control means for maintaining first and second stacks, placing an identifier of a packet on the first stack upon or after receipt thereof by the system, popping the packet identifier off the first stack and placing it on the second stack upon or after initiation of classification processing of the packet by the packet classification means, popping the packet identifier off the second stack upon or after completion of classification processing of the packet by the packet classification means, preventing egress of the packet from the system while the packet identifier is placed on either the first or second stacks, and allowing egress of the packet from the system upon or after the packet identifier has been popped from the second stack.

42. A packet modification system comprising:

means for buffering a packet upon or after ingress thereof to the system;

means for slicing some or all of a packet into portions and providing the portions in parallel over a first data path having a first width to modification means, the modification means configured for modifying the packet, or one or more portions thereof; and

means for assembling one or more modified portions of the packet with one or more unmodified portions of the packet retrieved directly from the means for

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buffering to form an assembled packet, and providing the assembled packet over a second data path having a second width less than the first width.

43.   A method of classifying a packet comprising:

a step for buffering the packet in a buffer upon or after ingress thereof;

5   a step for slicing some or all of a packet into portions and providing the portions in parallel over a first data path having a first width to a packet classification engine;

in the packet classification engine, a step for classifying the packet responsive to the one or more packet portions, and providing data representative of the packet

10   classification;

a step for associating the packet classification data with the packet as directly retrieved from the buffer to form an associated packet, and providing the same over a second data path having a second width less than the first width;

a step for placing an identifier of the packet on a first stack upon or after

15   ingress thereof;

a step for popping the packet identifier off the first stack and placing it on a second stack upon or after initiation of classification processing of the packet by the packet classification engine;

a step for popping the packet identifier off the second stack upon or after

20   completion of classification processing of the packet by the packet classification engine; and

a step for preventing egress of the packet while the packet identifier is on either the first or second stacks, and allowing egress of the packet upon or after the packet identifier has been popped off the second stack.

25   44.   A method of modifying a packet comprising:

a step for buffering a packet in a buffer upon or after ingress thereof;

a step for slicing some or all of a packet into portions and providing the portions in parallel over a first data path having a first width to a modification engine;

in the modification engine, a step for modifying the packet, or one or more

30   portions thereof; and

a step for assembling one or more modified portions of the packet with one or more unmodified portions of the packet as directly retrieved from the buffer to form an assembled packet, and providing the assembled packet over a second data path having a second width less than the first width.

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